

RadNet Alpha CAM Protocol

2/16/2004 8:59 PM

RadNet Alpha CAM Protocol

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RadNet Alpha CAM Protocol

2/16/2004 8:59 PM

RadNet Message Header Format

The RadNet header contains the **first 55 bytes** of all RadNet messages. The header is intended to provide information regarding the operational status and location of an instrument. The header provides information regarding which instruments are (or are not) operating properly.

Field Name	Type	Position	Codes	Notes
Header Check Sum	Byte	1		The first byte (01, byte) is a checksum, to ensure the integrity of the header transmission. The checksum is the sum of bytes 2 through 55.
RadNet Version Number	Byte	2	See RadNet Versions Page	The second byte (02, byte) is the RadNet version number. It is used to indicate the version of the RadNet message. The receiving software is responsible for handling all received RadNet messages, although the most current version's functionality may not be provided.
Message Codes	Byte	3	See RadNet Message Codes Page	Byte (03) is the message code. The message code tells what type of RadNet message has been sent (status, check source, etc.).
Server Address	Word	4-5	None	Bytes (4-5) are the server address (1-64,536) of the pushing device. Since each instrument may perform as its own server, two bytes are used.
Monitor Address	Byte	6	None	Byte (6) is the address (1-256) of a specific monitor hooked up to a server. This protocol is intended to support existing (RS-485) systems. The practicality of hooking up more than 256 monitors to a single RadNet server is questionable.
Server Status	Byte	7	See RadNet Server Status Codes Page	Byte (7) is a code to display the status of the server. Codes are provided for normal as well as a variety of abnormal conditions.
Hardware Status	Byte	8	See Op/Hw Status Page Codes Page	Byte (8) is a code to display the overall Hardware Status of the instrument. Hardware status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument hardware malfunctions generally require repair work. Other conditions could be attributed to either hardware or operational problems. The instrument vendors are responsible for classifying

RadNet Alpha CAM Protocol

2/16/2004 8:59 PM

				conditions and prioritizing the status change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage, and low background, then the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as a HV power supply failure.
Operational Status	Byte	9	See Op/Hw Status Page Codes Page	Byte (9) is a code to display the overall Operational Status of the instrument. Operational status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument operational problems generally require response by health physics personnel. Other conditions can be attributed to either hardware or operational problems. The instrument vendors are responsible for classifying conditions and prioritizing the status change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage, and low background, then the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as a HV power supply failure.
Location	Char[40]	10-49	None	Bytes (10-49) are for the location of the instrument. Location designations are highly individual, so no convention or specification is given. The location label must be left justified. Unused characters must be padded with space characters.
Authentication Byte Count Offset	Word	50-51		<p>The length in bytes of the original message. If non-zero, indicates that authentication is in effect. If zero, then authentication is not implemented</p> <p>See the following web pages for more information:</p> <p>Background Information RadNet Implementation, Authentication.</p>

RadNet Alpha CAM Protocol

2/16/2004 8:59 PM

				Encryption
Authentication Status	Byte	52	See RadNet Authentication Status Codes Page	"Invalid" flag. This byte is always set to zero when the message is transmitted. Authentication services set this byte to a non-zero value if the message fails signature verification. Clients check this byte with zero meaning valid data and take appropriate "bad data" action if the byte is non-zero. See the following web pages for more information: Background Information , RadNet Implementation , Authentication , Encryption
Reserved For Future Use	Byte	53	None	Byte (53) is reserved for future use and must be filled with zero values until specified by the protocol
Monitor Type	Word	54-55	See RadNet Monitor Type Codes Page	Bytes (54-55) are a code for the instrument type.

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Alpha CAM Message Body

The Ethernet frame size is limited to about 1500 Bytes. IP uses 28 bytes and UDP also uses eight of those 1500. An arbitrary limit of about 1200 bytes per RadNet data-gram has been set. This limit will help to ensure that we can continue future applications (both RadNet and Internet) without modifying this format.

Datagram Size Requirements (For 7 ROIs) Example

RadNet Fields	Num Of Bytes	Total
RadNet Header	55	55
Alpha CAM Body	5	60
Segment Id, Number Of Segments, Collection Time, Energy Calibration Offset, Energy Calibration Slope, Start Channel Number, Stop Channel Number, Number Of ROIs	19	79
7 ROIs (7 * 24 Bytes = 168 Bytes)	168	247
Scaling Factor Field	4	251
Number Of Channels Field	2	253
Reading (256 * 2 Bytes) = 512 Bytes	512	765 Bytes Total
Reading (512 * 2 Bytes) = 1024	1024	1277 Bytes Total

Field Name	Type	Position	Codes	Notes
Unique Id	Float	56-59		Date + Time + <i>any other unique value</i> . (e.g. mmddyyyyhhmmss + <i>mon address</i> + <i>server address</i> = 120219970812970462) If the CAM supports more than 512 channels, then the spectrum must be shipped in multiple messages. The Unique ID can also be used to match the spectrum data with the results data. If multiple messages are sent then the Unique ID is used to match the multiple messages to one another.
Alpha CAM Message Type	Byte	60	0 = Measurement 1 = Spectrum See Alpha CAM Message Type Page .	If Alpha CAM Message = 0 then see Alpha Cam Measurement Footer Page . The Alpha CAM Measurement Footer is pushed whenever there are any status changes or normal push frequency.

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

				If Alpha CAM Message = 1 then see Alpha CAM Spectrum Footer Page . This setting should be instrument configurable (Turn on/off RadNet spectrum shipping). When spectrum shipping is turned on, the Alpha CAM Spectrum Footer should be pushed after the measurement has been pushed whenever the CAM is alarmed. The CAM should always ship the measurement prior to shipping the spectrum.
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Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Alpha CAM Measurement Footer

Field Name	Type	Position	Codes	Notes
Stack Release Rate	Float	61-64		This value is a floating-point number. The units for this are Bq/s.
Flow Volume	Float	65-68		Byte (65-68) is the Flow Volume. This is a floating-point number value. The units for this are cc.
Flow Rate	Float	69-72		Byte (69-72) is the Flow Rate past the detector. This value is a floating-point number. The units for this are cc/s.
Filter Collect Time	Float	73-76		Filter Collect Time is the total time the filter has been collecting a sample. Units = seconds
Collection Time	Float	77-80		Collection Time is the total time the MCA/CAM has been acquiring data. Units = seconds
Number Of Measurements	Word	81-82		Byte (81-82) is the number of repeating frames that are contained after this value.
<i>Isotope</i>	<i>Char[16]</i>	<i>83-98...n</i>		<i>Isotope is the primary isotopes associated with this measurement. i.e. PU-239, U-239, Background, Radon, etc.</i>
<i>Dac Hours</i>	<i>Float</i>	<i>99-102...n</i>		<i>Dac Hours is the total DAC hours measured by the instrument. This is a floating-point number value.</i> <i>Units = Dac-hr</i>
<i>Error In Dac Hours</i>	<i>Float</i>	<i>103-106...n</i>		<i>Error in Dac Hours is the error associated with the DAC Hours value for the isotope.</i> <i>Units = %Dac-hr</i>
<i>Dac</i>	<i>Float</i>	<i>107-110...n</i>		<i>Dac is the total DAC measured by the instrument. This is a floating-point number value.</i> <i>Units = Dac</i>
<i>Concentration</i>	<i>Float</i>	<i>111-114...n</i>		<i>Concentration is the concentration measured by the instrument for the isotope.</i> <i>Units = Bq/cc</i>
<i>Error In Concentration</i>	<i>Float</i>	<i>115-118...n</i>		<i>Error In Concentration is error associated with the concentration value for the isotope.</i> <i>Units = Bq/cc</i>
<i>Net cps</i>	<i>Float</i>	<i>119-122...n</i>		<i>Net cps is the CPS value that has been</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

				<i>corrected for background subtraction, Radon compensation, or any other correction applied.</i> <i>Units = cps</i>
<i>Error In Net Cps</i>	<i>Float</i>	<i>123-126...n</i>		<i>Error in net cps is the error associated with the net CPS value.</i> <i>Units = cps</i>
<i>Uncompensated Cps</i>	<i>Float</i>	<i>127-130...n</i>		<i>Uncompensated cps is the CPS without any subtraction/correction (background, Radon, etc.) for the isotope.. This is a floating-point number value.</i> <i>Units = cps</i>
<i>Error In Uncompensated Cps</i>	<i>Float</i>	<i>131-134...n</i>		<i>Error in uncompensated cps is the error associated with the uncompensated CPS value.</i> <i>Units = cps</i>
<i>Detectability Limit</i>	<i>Float</i>	<i>135-138...n</i>		<i>Detectability limit is the LLD as defined by NUREG 4007 for the isotope.</i> <i>Units = Dac-Hrs</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Alpha CAM Spectrum Footer

Field Name	Type	Position	Codes	Notes
Segment ID	Byte	61		Segment ID is the sequential identification number of segment that is being pushed. [e.g. Segment ID = 2 (2 OF n) Number Of Segments = 3]
Number Of Segments	Byte	62		The number of segments is the total number of RadNet Spectrum footers being pushed. See Alpha CAM Body Page for byte requirement example. If the spectrum is > 512 channels then the CAM must ship the spectrum in multiple messages.
Collection Time	Float	63-66		Collection Time is the total time that the CAM has been collecting a sample. Units = seconds
Energy Calibration Offset	Float	67-70		<p>Energy Calibration Offset is a value that has been empirically determined to match locations of the radon daughter peaks on a "clean" filter. The offset value is subsequently reviewed in connection with each spectrum readout and modified as necessary when the peaks shift due to filter dust loading.</p> <p>Note: In connection with each spectrum analysis, the energy calibration slope and offset terms are used to determine the channels that are used to perform the analysis of the spectrum. The analysis regions are determined in units of energy, not in units of channels, and hence stay the same. However, as the filter becomes more and more loaded, the channels where the analysis is performed and where the peaks are, change. The energy calibration information can also be used to display the spectrum with an energy x-axis.</p> <p>Units = keV</p>
Energy Calibration Slope	Float	71-74		Energy Calibration Slope is used to reproduce the spectrum. The Energy Calibration Slope is a function of the electronics and does not change.

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

				<p>Note:</p> <p>In connection with each spectrum analysis, the energy calibration slope and offset terms are used to determine the channels that are used to perform the analysis of the spectrum. The analysis regions are determined in units of energy, not in units of channels, and hence stay the same. However, as the filter becomes more and more loaded, the channels where the analysis is performed and where the peaks are, are changed. The energy calibration information can also be used to display the spectrum with an energy x-axis.</p> <p>Units = keV/Channel</p>
Start Channel Number	Word	75-76		<p>The Start Channel number is the starting channel number of the spectrum within this message; e.g.,</p> <p>Number Of Segments = 2 Segment ID = 1 Start Channel = 1 Stop Channel = 512 Number Of Channels = 512 Segment ID = 2 Start Channel = 513 Stop Channel = 1024 Number Of Channels = 512</p>
Stop Channel Number	Word	77-78		<p>The Stop Channel number is the ending channel number of the spectrum within this message; e.g.,</p> <p>Number Of Segments = 2 Segment ID = 1 Start Channel = 1 Stop Channel = 512 Number Of Channels = 512 Segment ID = 2 Start Channel = 513 Stop Channel = 1024 Number Of Channels = 512</p>
Number Of ROI	Byte	79		<p>Number Of ROIs is the number of repeating ROIs contained within this message.</p> <p>If the CAM does not support this field, then 0 (zero) should be entered. If the number of ROIs contain a 0 (zero) then the next 3 fields will be omitted (then byte 80 will be scaling factor).</p>
<i>Analysis Region Start Energy</i>	<i>Float</i>	<i>80-83...n</i>		<i>The Analysis Region Start Energy is the beginning energy for this ROI(n)</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

				<i>region.</i> <i>Units = keV</i>
<i>Analysis Region Stop Energy</i>	<i>Float</i>	<i>84-87...n</i>		<i>The Analysis Region Stop Energy is the ending energy for this ROI(n) region.</i> <i>Units = keV</i>
<i>Label</i>	<i>Char[16]</i>	<i>88-103...n</i>		<i>The Label is the isotope label for this ROI(n) or any other descriptor i.e. PU-239, U-235, Mixed, etc.</i>
Scaling Factor	Float	104-107..n		Use this value to scale the largest reading to fit into the reading field. When the maximum number of counts/events > 64K client Software must take the reading multiplied by the scaling factor to obtain the actual results. E.g. For a reading of 88,480, the scaling factor would be 2.765 and the channel reading would be 32000 (32000 * 2.765 = 88480)
Number Of Channels (x)	Word	108-109..n		The Number Of Channels are the number of readings/channels that will be presented as repeating frames.
<i>Reading</i>	<i>Word</i>	<i>110-111...n</i>		<i>Reading is the counts/events for each channel.</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Example of Alpha CAM Spectrum Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
Start Of RadNet Header			
Header Check Sum	1	1	The check sum is calculated using byte 2 to 55.
RadNet Version	2	2	Value = 0
Message Code	3	3	Value = 0, standard RadNet message
Server Address	4	5	Value = 1 to 65535. This setting is user defined and must be unique to each instrument on the network.
Monitor Address	6	6	Value = 1 to 255 This setting is user defined and must be unique to each instrument on the network.
Server Status	7	7	Value = 0
Hardware Status	8	8	Value = 0
Operational Status	9	9	Value = 17, Dac Hours Alarm
Location	10	49	Value = "Alpha CAM, Bldg 10, Room 143, SN 19384***" * = ASCII Character Value 32 (blank space)
Authentication Byte Count Offset	50	51	Value = 0, No authentication is being done.
Authentication Status	52	52	Value = 0, No authentication is being done
R1	53	53	No used at this time
Monitor Type	54	55	Value = 4, Alpha CAM
End Of RadNet Header			
Start of Alpha CAM Monitor Body			
Unique Id	56	59	Value = 127637693767

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Alpha CAM Message Type	60	60	Value = 1
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End of Alpha CAM Monitor Body

Start Of Alpha Spectrum Message Footer

Segment ID	61	61	1
Number Of Segments	62	62	1
Collection Time	63	66	Value = 30 seconds
Energy Calibration Offset	67	70	Value = 700 keV
Energy Calibration Slope	71	74	Value = 40 keV
Start Channel Number	75	76	Value = 1
Stop Channel Number	77	78	Value = 11
Number Of ROI's	79	79	Number ROI Value = 4

Start Of ROI Repeating Frame Data

<i>Start Energy</i>	80	83	5001
<i>Stop Energy</i>	84	87	5014
<i>Label</i>	88	103	<i>Label = Pu-239</i>

End of ROI 1 Data

<i>Start Energy</i>	104	107	5016
<i>Stop Energy</i>	108	111	5130
<i>Label</i>	112	127	<i>Label = Pu-240</i>

End of ROI 2 Data

<i>Start Energy</i>	128	131	4385
<i>Stop Energy</i>	132	135	4400
<i>Label</i>	136	151	<i>Label = U-235</i>

End Of ROI 3 Data

<i>Start Energy</i>	152	155	4100
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Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

<i>Stop Energy</i>	156	159	4155
<i>Label</i>	160	175	<i>Label = U-238</i>
End Of ROI 4 Data			
End of ROI Repeating Frame Data			
Scaling factor	242	245	Value = 2.34523
Number of Channels	246	247	Number Of Channels Value = 11
Start of Number Channels Repeating Frames			
<i>C0</i>	248	249	<i>Value = 45</i>
<i>C1</i>	250	251	<i>Value = 11</i>
<i>C2</i>	252	253	<i>Value = 15</i>
<i>C3</i>	254	255	<i>Value = 56</i>
<i>C4</i>	256	257	<i>Value = 45</i>
<i>C5</i>	258	259	<i>Value = 39</i>
<i>C6</i>	260	261	<i>Value = 78</i>
<i>C7</i>	262	263	<i>Value = 33</i>
<i>C8</i>	264	265	<i>Value = 12</i>
<i>C9</i>	266	267	<i>Value = 8</i>
<i>C10</i>	268	269	<i>Value = 3</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

End of Number Channels Repeating Frames

End Of Alpha CAM Spectrum Message Footer

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Example of Alpha Spec Measurement Message Format:

RadNet Field	Start Byte Position	End Byte Position	Notes
Start Of RadNet Header			
RadNet Version	2	2	Value = 0
Message Code	3	3	Value = 0, standard RadNet message
Server Address	4	5	Value = 1 to 65535. This setting is user defined and must be unique to each instrument on the network.
Monitor Address	6	6	Value = 1 to 255 This setting is user defined and must be unique to each instrument on the network.
Server Status	7	7	Value = 0
Hardware Status	8	8	Value = 0
Operational Status	9	9	Value = 1, High Alarm
Location	10	49	Value = "Alpha CAM, Bldg 10, Room 143, SN 19384***" * = ASCII Character Value 32 (blank space)
Authentication Byte Count Offset	50	51	Value = 0, No authentication is being done.
Authentication Status	52	52	Value = 0, No authentication is being done
R1	53	53	No used at this time
Monitor Type	54	55	Value = 1, Neutron Area Monitor
End Of RadNet Header			
Start of Alpha CAM Monitor Body			
Unique Id	56	59	Value = 127637693767
Alpha CAM Message Type	60	60	Value = 0

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

End of Alpha CAM Monitor Body

Start Of Spectrum Message Footer

Stack Release Rate	61	64	Value = 0
Flow Volume	65	68	Value = 200.56
Flow Rate	69	72	Value = 2.12
Filter Collect Time	73	76	Value = 400
Collection Time	77	80	Value = 400
Number Of Measurement	81	82	Value = 4

Start of Number Of Measurement Repeating Frames

<i>Isotope</i>	83	98	<i>Value = Pu-239</i>
<i>Dac Hours</i>	99	102	<i>Value = 1</i>
<i>Error In Dac Hours</i>	103	106	<i>Value =5</i>
<i>Dac</i>	107	110	<i>Value =2.3</i>
<i>Concentration</i>	111	114	<i>Value =123</i>
<i>Error In Concentration</i>	115	118	<i>Value =4</i>
<i>Net cps</i>	119	122	<i>Value =1234</i>
<i>Error In Net cps</i>	123	126	<i>Value =5</i>
<i>Uncompensated cps</i>	127	130	<i>Value =4567</i>
<i>Error In Uncompensated cps</i>	131	134	<i>Value =5</i>
<i>Detectability Limit</i>	135	138	<i>Value =1</i>

End Of Measurement 0 Data

<i>Isotope</i>	139	154	<i>Value =Pu-238</i>
<i>Dac Hours</i>	155	158	<i>Value =1</i>
<i>Error In Dac Hours</i>	159	162	<i>Value =5</i>
<i>Dac</i>	163	165	<i>Value =2.3</i>
<i>Concentration</i>	166	169	<i>Value =145</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

<i>Error In Concentration</i>	170	171	<i>Value =5</i>
<i>Net cps</i>	172	175	<i>Value =234</i>
<i>Error In Net cps</i>	176	179	<i>Value =5</i>
<i>Uncompensated cps</i>	180	183	<i>Value =456</i>
<i>Error In Uncompensated cps</i>	184	187	<i>Value =5</i>
<i>Detecablilty Limit</i>	188	191	<i>Value =1</i>

End Of Measurement 1 Data

<i>Isotope</i>	192	207	<i>Value =PU-239 and Pu-238</i>
<i>Dac Hours</i>	208	211	<i>Value =3</i>
<i>Error In Dac Hours</i>	212	215	<i>Value =5</i>
<i>Dac</i>	215	218	<i>Value =5</i>
<i>Concentration</i>	219	222	<i>Value =456</i>
<i>Error In Concentration</i>	223	226	<i>Value =5</i>
<i>Net cps</i>	227	230	<i>Value =678</i>
<i>Error In Net cps</i>	231	234	<i>Value =5</i>
<i>Uncompensated cps</i>	235	238	<i>Value =789</i>
<i>Error In Uncompensated cps</i>	241	244	<i>Value =5</i>
<i>Detecablilty Limit</i>	245	248	<i>Value =1</i>

End Of Measurement 2 Data

<i>Isotope</i>	249	264	<i>Value = U-235</i>
<i>Dac Hours</i>	265	258	<i>Value =0</i>
<i>Error In Dac Hours</i>	259	262	<i>Value =5</i>
<i>Dac</i>	263	266	<i>Value =0</i>
<i>Concentration</i>	267	270	<i>Value =0</i>
<i>Error In Concentration</i>	271	274	<i>Value =5</i>
<i>Net cps</i>	275	278	<i>Value =0</i>
<i>Error In Net cps</i>	279	282	<i>Value =5</i>
<i>Uncompensated cps</i>	283	285	<i>Value =0</i>
<i>Error In Uncompensated cps</i>	286	289	<i>Value =5</i>
<i>Detecablilty Limit</i>	290	293	<i>Value =.5</i>

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

End Of Measurement 3 Data

End of Number of Measurement Repeating Frames

End Of Measurement Message Footer

Alpha CAM Monitor Protocol

2/16/2004 8:59 PM

Alpha CAM Footer Codes

Code	Meaning	Notes
0	Alpha CAM Measurement Message	Alpha CAM Measurement Data Follows the body. See Alpha CAM Measurement Footer Page for more information.
1	Alpha Cam Spectrum Message	Alpha CAM Spectral Data Follows the Body. See Alpha CAM Spectrum Footer Page for more information.

Standard RadNet Header Codes

2/16/2004 8:59 PM

Authentication Status Codes

See the following pages for more information concerning RadNet Security Implementation:

[Background Information](#)
[RadNet Security Implementation](#)
[Authentication](#)
[Encryption](#)

These codes indicate whether a RadNet message has been authenticated (message fails signature verification). RadNet message(s) are directed to/at a RadNet Authentication Server (RAS) or other device. The RAS will authenticate the message and set byte 52 to indicate the status of the authentication process. The RAS server will then forward the message to clients on the network. It is important that the RAS server is secure and that the data leaving the RAS server is on a secure network (the message will not be tampered with after authenticated). It is also important to note that the RAS server does not strip the authentication keys from the message, and the authentication process could be done at any time, including storing the authentication signature within a database for future verification of the message.

The Authentication software/server will set this byte value to indicated message signature verification status.

Code	Meaning	Notes
0	Message is Ok	
>0	Message fails signature verification.	

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Channel Types

Below is a code for type of channel.

Code	Meaning	Notes
0	Alpha	
1	Beta	
2	Gamma	
3	Neutron	
4	Iodine	
5	Noble Gas	
6	Tritium	
7	Stack Flow	
8	Sample Flow	
9	Temperature	
10	Sample Pressure	
11	Leak rate	Primary to secondary, or containment building leak
12	Reactor power	Used for leak measurements
13	Beta + Gamma	The sum of the beta and gamma channels.
14	Latitude	
15	Longitude	
16	Altitude	
17	Humidity	
18	Wind Speed	
19	Wind Direction	
20	Alpha/Beta	
21	Pulse Height Analysis (PHA)	
22	Dust Particle	
23	Humidity	
24	Anemometer	

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Monitor Type Codes

Bytes (54-55) are code for the instrument type.

Code	Meaning	Notes
0	Gamma Area Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
1	Gamma Crit Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
2	Neutron Area Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
3	Neutron Crit Monitor	Uses the Area Monitor body and footer format. See Area Monitor Header, Body, Footer, and Notes for more information.
4	Alpha CAM	Uses the Alpha CAM body, Measurement Footer, Spectrum Footer. See Alpha CAM Header, Body, Measurement Footer, Spectrum Footer and Notes for more information.
5	Beta CAM	Uses the Beta Cam body and footer format. See Beta CAM Header, Body, Footer and Notes for more information.
6	PCM Monitor	Uses the PCM body and footer format. See PCM Header, Body, Footer and Notes for more information.
7	PCM Portal Monitor	Uses the PCM Body and Footer format. See Portal Header, Body, Footer and Notes for more information.
8	PING	Uses the PING Body and Footer format. See PING Header, Body, Footer and Notes for more information.
9	Glove Box Monitor/Hand Monitor	Uses The PCM Body and Footer format. See PCM Header, Body, Footer and Notes for more information.

Standard RadNet Header Codes

2/16/2004 8:59 PM

10	Hand And Foot Monitor	Uses The PCM Body and Footer format. See Hand and Foot Header, Body, Footer and Notes for more information.
11	Generic Sensor	Uses The Generic Sensor Body and Footer format. See Generic Sensor Header, Body, Footer and Notes for more information.
12	Electronic Reading Dissymmetry	See Header, ERD Body, ERD Footer, for more information.
13	Item Contamination Monitor (ICM)	Uses The ICM Body and Footer format. See Header, Body, Footer and Notes for more information.
14	Radiation Gateway Monitor	Uses The Radiation Gateway Body and Footer format. See Header, Body, Footer and Notes for more information.
15	Gamma Spectrum	Uses The Gamma Spectrum Body, Measurement, Spectrum, Status and Footer format. See Header, Body, Measurement, Spectrum, Status and Notes for more information.
16	Portable Instruments	Protocol Pending, in development by vendor
17	Meteorology Tower	Uses The Meteorology Tower Body and Footer format. See Header, Body, Measurement, Status, and Notes for more information.
18	Video	Uses The Video Body, Status and Footer format. See Header, Body, Footer, Status and Notes for more information.
19	Image	Protocol Pending, in development by vendor
20	Audio	Protocol Pending, in development by vendor
21	Security data tag/seal	Protocol Pending, in development by vendor
22	Tritium Air Monitor	Protocol Pending, in development by vendor
23	Dust Particle Monitor	Protocol Pending, in development by vendor

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Message Codes

Byte (03) is the message code. The message code indicates what type of RadNet message has been sent (status, check source, etc.).

Code	Meaning	Notes
0	Normal/Standard RadNet Message	Message is pushed by the instrument and received by the clients.
1	Alarm Ack	Message is pushed by the clients and received by the instruments. See Alarm Acknowledge Alarm Msg. Notes and Alarm Acknowledge Header Format
2	Pass Through	Message is pushed by the instrument and received by the client or can be pushed by the client and received by the instrument. This method can be used for bi-directional communication by the clients and instruments. See Pass Through Msg. Header Notes / Pass Through Header Format or Pass Through Codes
3	Check Source	Message is pushed by the clients and received by the instruments. See Check Source Msg. Notes and Check Source Header Format
4	Diagnostic/Self-Check	Message is pushed by the clients and received by the instruments. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format
5	Request Data	A client/server sends this request to an instrument. In response to this request the instrument will send its current information (Normal RadNet Message). See Request Data Notes and Request Data Header Format
6	Update/Request Date/Time	A client/server sends this request to an instrument. In response to this request the instrument will send/set the date/time. See Update/Request Date/Time Notes and Update/Request Date/Time Header Format
7	Acknowledge Receipt	This message is used by the monitoring computer to acknowledge receipt of data from an instrument. See Acknowledge Receipt Message Header Format and Acknowledge Receipt Message Notes for more information.
255 (FFh)	Encrypted RadNet Message	See the following pages for more information: Background Information RadNet Implementation

Standard RadNet Header Codes

2/16/2004 8:59 PM

		Encryption Header Message Format Encryption Background Information
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Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Operational and Hardware Status Codes

Note: It is the responsibility of the instrument manufacturer to prioritize the operational and hardware status for the instrument. Any status code can be used either as an operational or hardware status code base upon the instrument usage or needs.

Below is a code used to display the Hardware/Operational Status of the instrument. Hardware status is intended to be a troubleshooting guide when responding to an abnormal condition. Instrument hardware malfunctions generally require repair work. Other conditions may be attributed to either hardware or operational problems. Instrument vendors are responsible for classifying conditions and prioritizing the status change. The intention is that only the most critical status change be pushed; however a series of messages based upon a list of status changes could also be pushed. For example: If the instrument detected failures with low voltage and low background, the vendor could push each status in a separate message (at the abnormal push rate). These statuses could then be interpreted by the client as an HV power supply failure.

OP = Guide For Operational Status Use

HW = Guide For Hardware Status Use

Code	Meaning	OP	HW	Notes
0	Normal	Y	Y	
1	High Alarm	Y	N	
2	HV Fail	N	Y	
3	Count Fail	Y	N	
4	Bkg Fail	Y	N	
5	Bkg Update	Y	N	
6	Comm Fail	N	Y	
7	Gas Empty	Y	N	
8	Buffer Full	Y	Y	
9	Acked High Alarm	Y	N	
10	Flow Fail Low	Y	Y	
11	Flow Fail High	Y	Y	
12	Filter Door Open	Y	N	
13	Instrument Not Ready	Y	Y	
14	Instrument In Calibration Mode	Y	Y	
15	Fast Concentration Alarm	Y	N	
16	Slow Concentration Alarm	Y	N	
17	DAC Hours Alarm	Y	N	
18	Count Rate Alarm	Y	Y	
19	Release Rate Alarm	Y	N	

Standard RadNet Header Codes

2/16/2004 8:59 PM

20	Fast Concentration Alarm Disabled	Y	N	
21	Slow Concentration Alarm Disabled	Y	N	
22	Count Rate Alarm Disabled	Y	N	
23	Check Source Mode	Y	N	
24	Out Of Service	Y	Y	
25	Alert Alarm	Y	N	
26	Trend Alarm	Y	N	
27	Not Initialized	Y	Y	
28	Standby	Y	Y	
29	Local Control	Y	Y	
30	Flush	Y	N	
31	Alarm Disabled	Y	N	
32	External Fail	Y	Y	
33	AC Off	Y	Y	
34	Crit Relay Fail	Y	Y	
35	Out Of Limits	Y	Y	
36	Crit Alarm	Y	N	
37	NV RAM Fail	N	Y	When the instrument's non-volatile RAM cannot be read/written.
38	Check Source Results	N	Y	Indicates that the message with this status carries check source results. This indicates that this message contains the final check source result at the completion of the check source integration. Prior to this code being sent the status code would be 23 (<i>Check Source Mode</i>).
39	Audio Failure	N	Y	Indicates that the instrument has a problem with its audio circuit.
40	Over Range	Y	Y	Indicates that the instrument has exceeded an Over Range value.
41	Diagnostic/Self-check completed, Passed self-check	Y	Y	Indicates that the instrument has performed an Internal Diagnostic/Self-check and found no error conditions. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format

Standard RadNet Header Codes

2/16/2004 8:59 PM

42	Diagnostic/Self-check completed, Failed self-check	Y	Y	Indicates that the instrument has performed an Internal Diagnostic/Self-check and found error conditions. See Diagnostic/Self-Check Msg. Notes and Diagnostic/Self-Check Header Format
43	High/High Alarm	Y	N	Third alarm level used in many plants.
44	Internal stabilization failure	Y	N	From automatic energy stabilization.
45	Parameter error	Y	N	Bad setup.
46	Temperature failure	N	Y	Temperature out of operational range.
47	Power supply failure	N	Y	From power supply, or from voltage reading.
48	Analog input failure	N	Y	4-20 mA analog input failure (0 mA for example).
49	Filter failure	N	Y	Automatic filter advance failure (motor, end of roll...).
50	Detector cable failure	N	Y	
51	Electronic or Acquisition board failure	N	Y	Electronic failure.
52	Low Battery	N	Y	Backup battery or internal battery has a low voltage condition.
53	Battery Failed	N	Y	Backup battery or internal battery has failed.
54	Clock Failed	N	Y	Internal clock has failed.
55	User defined	Y	Y	This error code is used whenever an instrument supports user defined error codes. It is used whenever there is a desire to inform a user that one of their error conditions has been reached. Since there is no way of knowing what is contained in the error code logic, this generic response should be used to indicate the error.
56	Internal Communication Failure	N	Y	

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Versions

Note: The last approved version in this list is the current version in use by RadNet.

The second byte (02, byte) is the RadNet version number. This number is used to indicate the version of RadNet be pushed by the server. It is the responsibility of the receiving software to handle all received RadNet messages, although the most current version's functionality may not be provided.

Version	Date Approved	Notes
0	Approved	

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Units Codes

Below is a code for the RadNet units of the reading.

Code	Meaning	Notes
0	cps	
1	Rem/hr	
2	R/hr	
3	Sv/hr	
4	Bq/cm3	
5	Bq	
6	Degrees Centigrade (C)	Temperature Unit
7	Pascal (Pa)	Pressure Unit
8	cc	Flow Volume Unit
9	cc/sec	Flow Rate Unit
10	cps/cc	Activity Unit
11	counts	Counting Events Unit
12	cm/sec	Velocity Unit
13	bqMeV/cc	Gamma Gas Activity
14	degrees	Wind Direction (180 = south)
15	Gy/hr	Dose Rate Unit
16	RPU%	Reactor Power Unit
17	Kg/sec	Masse flow rate
18	n/cm2	Neutrons / cm2
19	n/cm3	Neutrons / cm3
20	DAC	Derived Air Concentration
21	bq/m3	Becquerel per cubic meter
22	bq/kg	Becquerel per kilogram
23	Latitude	
24	Longitude	
25	Mu_Hemin	Hemisphere North
26	Mu_Hemis	Hemisphere South
27	Mu_Hemie	Hemisphere East
28	Mu_Hemiw	Hemisphere West
29	Mu_Knots	Wind Speed (knots)
30	Mu_KPH	Wind Speed (knots per hour)
31	Mu_MPS	Wind Speed (meters per second)
32	Mu MPH	Wind Speed (meters per hour)

Standard RadNet Header Codes

2/16/2004 8:59 PM

33	Mu_METERS	Altitude (meters)
34	Mu_Feet	Altitude (feet)
35	Mu_Percent	Humidity
36	Resistance	Electrical Resistance
37	um	Micro-meter

Standard RadNet Header Codes

2/16/2004 8:59 PM

RadNet Server Status Codes

Byte (7) is a code that displays the status of the server. Codes are provided for normal as well as a variety of abnormal conditions. See Appendix A for Server Status message codes.

Code	Meaning	Notes
0	Normal Operation	
1	Instrument Communication Error	
2	TCP Communication Error	
3	UDP Communication Error	
4	Hard Disk Full	
5	Password Fail	
6	Starting Up	
7	Shutting Down	
8	Program Error	
9	NetWork Access Granted	
10	NetWork Access Denied	